No. 200500312

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Washington State University Research Foundation

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE , OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

WHEAT, COMMON

'Otis'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this fifth day of July, in the year two thousand and six.

Attest:

Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Secretary of Agriculture

REPRODUCE LOCALLY. *Include form number and date on all reproductions* — Form Approved - OMB No. 0581-0055

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF OWNER
Washington State University Research Foundation

2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME
WA007931

3. VARIETY NAME
Otis

4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP Code, and Country)*
1610 NE Eastgate Blvd.
Pullman, WA 99163

5. TELEPHONE *(include area code)*
(509) 335-4363

6. FAX *(include area code)*
(509) 335-7237

FOR OFFICIAL USE ONLY

PVPO NUMBER
200500312

FILING DATE
August 4, 2005

7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION *(corporation, partnership, association, etc.)*
Corporation

8. IF INCORPORATED, GIVE STATE OF INCORPORATION
WA

9. DATE OF INCORPORATION
July 7, 1939

10. NAME AND ADDRESS OF OWNER REPRESENTATIVE(S) TO SERVE IN THIS APPLICATION. *(First person listed will receive all papers)*
Dr. Keith Jones, Director
Washington State University Research Foundation
1610 NE Eastgate Blvd.
Pullman, WA 99163

FEES RECEIVED
FILING AND EXAMINATION FEES:
$ 3652.00
DATE 8/04/2005
CERTIFICATION FEE:
$ 768.00
DATE June 6, 2006

11. TELEPHONE *(Include area code)*
(509) 335-4363

12. FAX *(Include area code)*
(509) 335-7237

13. E-MAIL
jonesk@wsu.edu

14. CROP KIND *(Common Name)*
Spring wheat

16. FAMILY NAME *(Botanical)*
Gramineae

15. GENUS AND SPECIES NAME OF CROP
Triticum aestivum L.

17. IS THE VARIETY A FIRST GENERATION HYBRID?
☐ YES ☑ NO

18. DOES THE VARIETY CONTAIN ANY TRANSGENES? *(OPTIONAL)*
☐ YES ☑ NO
IF SO, PLEASE GIVE THE ASSIGNED USDA-APHIS REFERENCE NUMBER FOR THE APPROVED PETITION TO DEREGULATE THE GENETICALLY MODIFIED PLANT FOR COMMERICALIZATION. _____

19. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED
(Follow instructions on reverse)

a. ☑ Exhibit A. Origin and Breeding History of the Variety
b. ☑ Exhibit B. Statement of Distinctness
c. ☑ Exhibit C. Objective Description of Variety
d. ☑ Exhibit D. Additional Description of the Variety *(Optional)*
e. ☑ Exhibit E. Statement of the Basis of the Owner's Ownership
f. ☑ Voucher Sample *(2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository)*
g. ☑ Filing and Examination Fee ($3,652), made payable to "Treasurer of the United States" *(Mail to the Plant Variety Protection Office)*

20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? *(See Section 83(a) of the Plant Variety Protection Act)*
☐ YES *(If "yes", answer items 21 and 22 below)* ☑ NO *(If "no", go to item 23)*

21. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES?
☐ YES ☐ NO
IF YES, WHICH CLASSES? ☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED

22. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☐ YES ☐ NO
IF YES, SPECIFY THE NUMBER 1,2,3, etc. FOR EACH CLASS.
☐ FOUNDATION ☐ REGISTERED ☐ CERTIFIED
(If additional explanation is necessary, please use the space indicated on the reverse.)

23. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES?
☑ YES ☐ NO
IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. *(Please use space indicated on reverse.)*

24. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT *(PLANT BREEDER'S RIGHT OR PATENT)*?
☐ YES ☑ NO
IF YES, PLEASE GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. *(Please use space indicated on reverse.)*

25. The owners declare that a viable sample of basic seed of the variety has been furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate.

The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act.

Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF OWNER		SIGNATURE OF OWNER	
Keith Jones			
NAME *(Please print or type)*		NAME *(Please print or type)*	
Dr. Keith Jones			
CAPACITY OR TITLE	DATE	CAPACITY OR TITLE	DATE
Director	8/2/05	Director	

(See reverse for instructions and information collection burden statement)

ST-470 (04-03) designed by the Plant Variety Protection Office using Word 2002.

INSTRUCTIONS

20050312

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be **received** in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to **reproduce** the variety, or for tuber reproduced varieties verification that a viable *(in the sense that it will reproduce an entire plant)* tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for $3,652 ($432 filing fee and $3,220 examination fee), payable to "Treasurer of the United States" *(See Section 97.6 of the Regulations and Rules of Practice.)* Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfiled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 401, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of $432 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office
Telephone: (301) 504-5518
FAX: (301) 504-5291
Homepage: http://www.ams.usda.gov/science/pvpo/pvpindex.htm

To avoid conflict with other variety names in use, the applicant must check the appropriate recognized authority and provide evidence that name has been cleared by the appropriate recognized authority before the Certificate of Protection is issued. For example, for agricultural and vegetable crops, contact: Seed Branch, AMS, USDA, 10301 Baltimore Avenue, Suite 401 NAL Building, Beltsville, MD 20705. Telephone: (301) 504-5682 http://www.ams.usda.gov/lsg/seed.htm.

ITEM

19a. Give:
(1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified

19b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:

(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.

19c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.

19d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, *etc.*

19e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.

20. If "Yes" is specified *(seed of this variety be sold by variety name only, as a class of certified seed)*, the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. *(See Regulations and Rules of Practice, Section 97.103).*

23. *See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.*

24. *See Section 55 of the Act for instructions on claiming the benefit of an earlier filing date.*

22. CONTINUED FROM FRONT *(Please provide a statement as to the limitation and sequence of generations that may be certified.)*

NA

23. CONTINUED FROM FRONT *(Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.)*

Sold as Foundation seed on 3/27/05.

24. CONTINUED FROM FRONT *(Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).)*

NA

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. The fees for filing a change of address; owner's representative; ownership or assignment; or any modification of owner's name is specified in Section 97.175 of the regulations. *(See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.)*

ST-470 (04-03) designed by the Plant Variety Protection Office using Word 2002.

EXHIBIT A - BREEDING HISTORY

'Otis'

1. Genealogy: Idaho 377s (PI 591045)/3/'Tanager 'S'' (PI 519878)/'Torim 73' (PI 433769)//'Spillman' (PI 506350)

2. Stages of Selection and Multiplication:
1994: Final cross made: WSU research land.

1995: F_1 generation; advanced on WSU research land; all plants uniform; no variants observed.

1995-1996 fall-winter: F_2 bulk population; WSU greenhouse. Plants were segregating for red and white seed color. White seeds were separated by hand, and were bulked together to create a hard white F_3 population.

1996: F_3 bulk population; WSU research land; no selection applied; segregating for maturity, plant height, and disease resistance; no variants observed.

1997: F_4 bulk population; WSU research land; selected 150 random spikes; segregating for maturity, plant height, and disease resistance; no variants observed.

1998: $F_{4:5}$ head row; WSU research land; selected based on appropriate plant height, head type, maturity, and disease resistance; no variants were observed within the single row.

1999: $F_{4:6}$ Single Plot Nursery (tested as HWN990071); WSU research land; selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2000: $F_{4:7}$ Preliminary Yield Trial; WSU research land; selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2001: $F_{4:8}$ State Advanced Yield Trial; WSU research land; selected based on appropriate plant height, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

2002: $F_{4:9}$ WSU Commercial Variety Trial; Tri-State Variety Trial (WA, OR, ID) (tested as WA007931); selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

EXHIBIT A - BREEDING HISTORY, cont.

2003: $F_{4:10}$ WSU Commercial Variety Trial; Tri-State Variety Trial (WA, OR, ID), Nursery, Western Regional Performance Nursery; selected based on appropriate plant height, head type, maturity, field resistance to stripe rust, grain protein content, test weight, grain yield, and milling/baking quality; no variants were observed within the plot.

Individual $F_{4:10}$ heads (1200) of Otis were hand-threshed and separately planted in 10 ft rows (headrows) in March 2003 with irrigation in Othello, WA for Breeder seed production. Breeder seed was bulk harvested from a reselection of the headrow block, based on phenotypic uniformity, in August 2003 and planted in March 2004 for Foundation seed production; no variants were observed within the block.

2004: WA007931 approved for release as the cultivar 'Otis': PI 634866

3. Evidence of uniformity and stability:

Otis has been observed to be stable and uniform with respect to plant morphology since 1998 as an F_4-derived line. This represents six generations (1998-2003) through which this stability and uniformity was observed. Otis also was observed uniform and stable throughout the certified seed increase process (2003-2005).

4. Variants during reproduction:

Otis contains a red wheat variant that was observed at a level of 6 to 10 seed per 1000 g in Breeder and Foundation seed increases.

EXHIBIT B. – STATEMENT OF DISTINCTNESS

Otis was released as a replacement for the hard white spring variety 'Idaho 377s' (PI 591045) in the semi-arid to intermediate rainfall (<400 mm of average annual precipitation), nonirrigated wheat production regions of Washington State based on its high grain yield potential, high-temperature adult-plant resistance to local races of stripe rust (*Puccinia striiformis* Westend. f. sp. *tritici),* partial resistance to the Hessian fly [*Mayetiola destructor* (Say)], and superior dual purpose end-use quality for making noodle and bread products. Otis is most similar to the hard white common varieties Idaho 377s and 'Macon' (PI 617072).

A. Agronomic Characteristics

Heading date (Day of Year (DOY)) and plant height (cm) data for Otis, Idaho 377s and Macon are described below. Number of plants used: 3 replications of 10 plants from each trial (*150 plants for each variety overall).*

1. Analysis of variance combined over locations indicates that the heading date of Otis is later than Idaho 377s (Mean = 3.9 days) and Macon (Mean = 6.4 days) with an LSD of 0.8 ($P \leq 0.05$) under Washington State field conditions. Data for each location, as well as over locations, are shown in Table B1.

2. Analysis of variance combined over locations indicates that Otis is taller than both Idaho 377s (Mean = 12 cm) and Macon (Mean = 13 cm) with an LSD of 2.1 ($P \leq 0.05$) under Washington State field conditions. Data for each location, as well as over locations, are shown in Table B1.

Table B1. Heading dates (Day of Year) and plant heights (cm) of Otis, Macon and Idaho 377s in commercial variety trials at 5 locations in Washington State in crop year 2004.

		Location					
Planting/Harvest Dates (DOY)		69/208	78/202	91/222	67/208	74/215	
Trait	Variety	Lind	Horse Heaven	St. John	Connell	Moses Lake	Mean
Heading Date (DOY)	Otis	151	153	170	149	160	156.6
	Idaho 377s	148	148	165	145	158	152.7
	Macon	147	143	163	142	156	150.2
	Mean	148.9	147.8	165.8	145.7	157.9	153.2
	LSD (5%)	1.5	3.7	1.1	1.3	3.1	0.8
	SD	2.0	4.4	3.3	3.1	1.9	9.8
	CV	0.5	1.1	0.3	0.4	0.9	0.7
Plant Height (cm)	Otis	88.1	80.4	99.1	82.1	113.5	92.6
	Idaho 377s	75.4	73.7	86.4	68.6	99.1	80.6
	Macon	74.5	72.8	88.1	67.7	94.8	79.6
	Mean	79.3	75.6	91.2	72.8	102.5	84.3
	LSD (5%)	3	3.8	5.6	8.5	8.5	2.1
	SD	6.7	4.0	6.3	7.7	9.1	13.8
	CV	1.7	2.2	2.7	5.1	3.7	3.3

*Combined analysis of variance was conducted after the assumptions required for combing data over locations were met (i.e. variances were homogenous and data were normally distributed).

B. Genetic Characteristics

The novelty of Otis is demonstrated by high-molecular weight (HMW) glutenin profiles (Payne et al. 1983) and microsatellite fingerprint data that, in combination, differentiate Otis from Idaho 377s and Macon. HMW glutenins were resolved via SDS-Page, and visualized using Coomassie Brilliant Blue (Payne and Lawrence, 1983). Glutenin profiles were recorded using a Polaroid camera to capture gel images, which were scanned into the computer followed by labeling in Microsoft Powerpoint (Figure 1). Amplified fragments from microsatellite markers were resolved in denaturing polyacrylamide gels and visualized using a Li-cor DNA Sequencer (Li-cor, Lincoln, NE) (Figure 2).

The HMW glutenin profile of Otis is heterogeneous, consisting of the banding profiles [2* 7+8 5+10], [2* 7+9 5+10] and [2* 6+8 5+10] in 5%, 45% and 55% of the population, respectively (Figure 1). The HMW glutenin profile for Idaho 377s also is heterogeneous with 30 % and 70% of plants within the population with the profile [2* 6+8 5+10] and [2* 5+10 17+18], respectively. All (100%) of Macon plants tested had the HMW glutenin profile [2* 5+10 17+18].

The uniqueness of Otis is verified by two microsatellite markers, *Xgwm132* and *Xgwm219*, which distinguish Otis from Idaho 377s and Macon. *Xgwm132* is located on wheat chromosome 6BS, between RFLP loci *Xrz995* (proximal) and *Xcdo476* (distal), whereas *Xgwm219* is located at the terminus of the long arm of chromosome 6B between RFLP locus *XksuG30* (proximal) and the telomere (distal) (Röder et al., 1998). The first microsatellite marker, *Xgwm132,* amplified a DNA fragment of 107 base pairs (bp) in Otis and Idaho 377s, whereas the same primer amplified two fragments 120 bp and 127 bp in Macon (Figure 2A). The second microsatellite marker, *Xgwm219,* revealed a 179 bp fragment in Otis and Macon, whereas the same primer amplified 188 bp fragment in Idaho 377s (Figure 2B). Therefore, these two microsatellite markers, when used in combination, can distinguish the cultivar Otis from Idaho 377s and Macon.

References:

Payne, PI, and GJ Lawrence. 1983. Catalogue of alleles for the complex gene loci, Glu-A1, Glu-B1, and Glu-D1, which code for high-molecular-weight subunits of glutenin in hexaploid wheat. Cer. Res. Comm. 11:29-35.

Röder MS, V Korzun, K Wendehake, J Plaschke, M-H Tixier, P Leroy, and MW Ganal. 1998. A microsatellite map of wheat. Genetics 149:2007-2023.

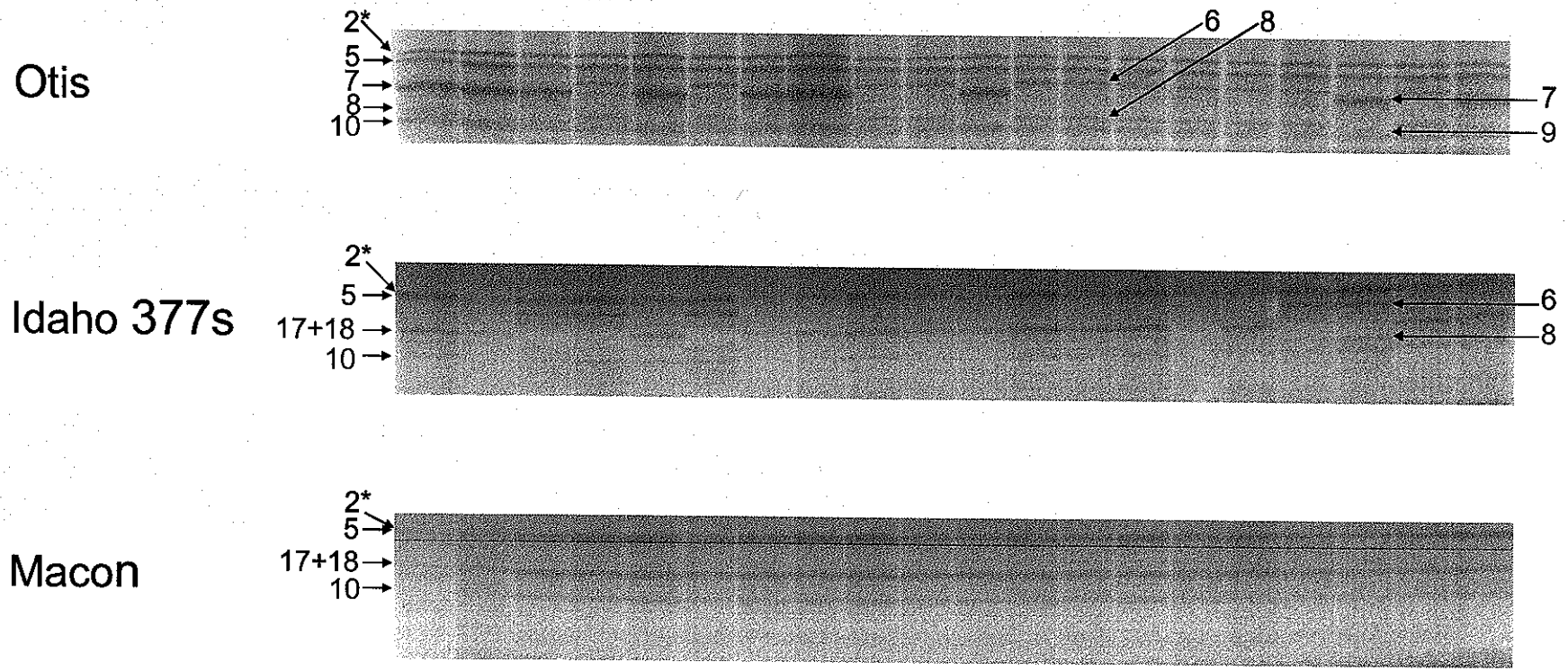

Figure 1. High-molecular weight glutenin profiles of bulked (first lane) and individual (19) progeny extracts of Otis, Idaho 377s and Macon kernels. Individuals within Otis had one of three glutenin profiles: [2* 7+8 5+10], [2* 7+9 5+10] or [2* 6+8 5+10]. Individuals within Idaho 377s were [2* 5+10 17+18] or [2* 6+8 5+10], and individuals within Macon were [2* 5+10 17+18]. Proteins were resolved via SDS-Page, and visualized using Coomassie Brilliant Blue (Payne and Lawrence, 1983).

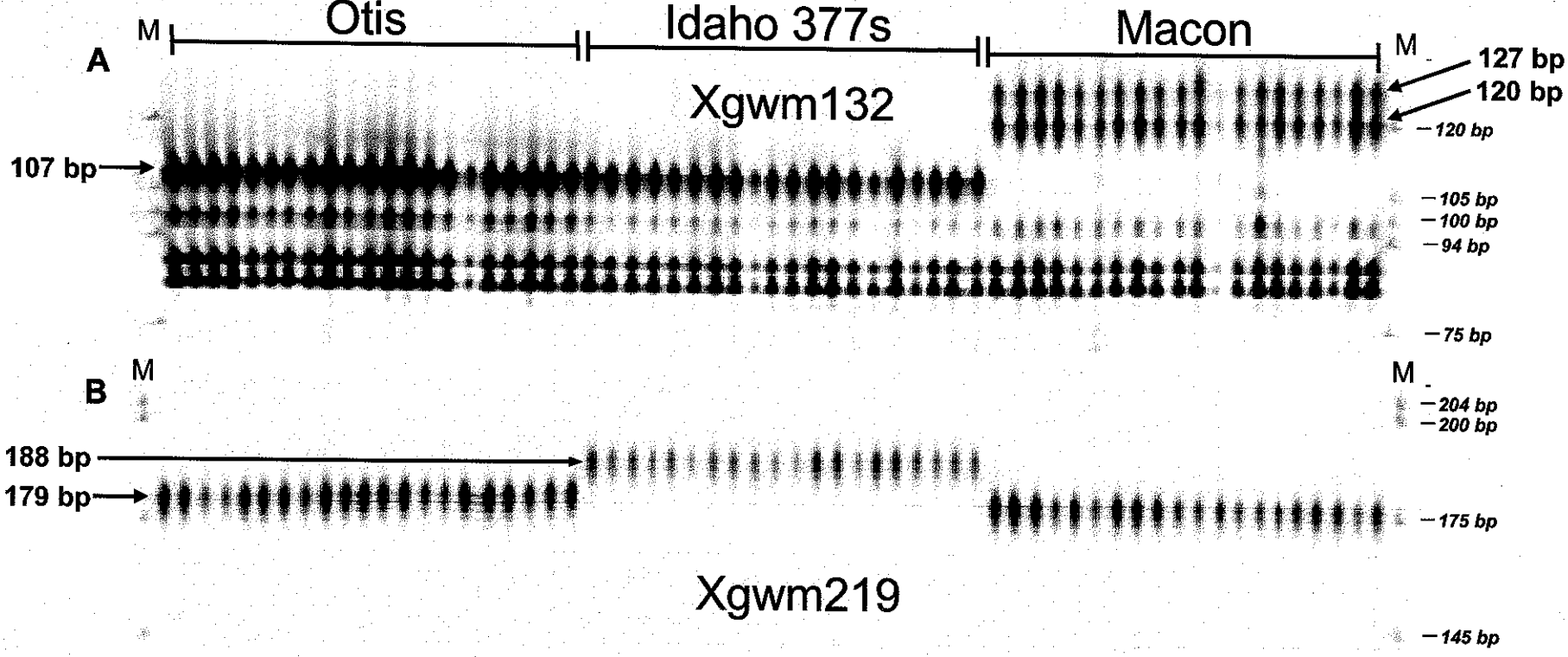

Figure 2. Microsatellite loci *Xgwm132* (A) and *Xgwm219* (B) on wheat chromosomes 6BS and 6BL, respectively, amplified from bulked (first lane for each cultivar) and 20, 19 and 19 individual plants of Otis, Idaho 377s and Macon, respectively. A fragment of 107 basepairs (bp) was amplified in Otis and Idaho 377s, whereas 120 bp and 127 bp fragments were amplified in Macon using Xgwm132. A fragment of 179 bp was amplified in Otis and Macon, whereas a 188 bp fragment was amplified in Idaho 377s using *Xgwm219*. DNA was obtained from young leaf tissue and the amplified products were resolved in denaturing polyacrylamide followed by visualization with an automated DNA Li-cor Sequencer (Li-cor, Lincoln, NE). The forward primer was labeled with fluorescent dye detected at 700 nanometers. The first and last lanes, labeled "M", contain molecular weight standards.

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY
PLANT VARIETY PROTECTION OFFICE
BELTSVILLE, MD 20705

Exhibit C

OBJECTIVE DESCRIPTION OF VARIETY
Wheat (*Triticum* spp.)

NAME OF APPLICANT (S)	TEMPORARY OR EXPERIMENTAL DESIGNATION	VARIETY NAME
Washington State Univesity Research Foundation	WA007931	Otis

ADDRESS (*Street and No. or RD No., City, State, Zip Code and Country*)
1610 NE Eastgate Blvd.
Pullman, WA 99163

FOR OFFICIAL USE ONLY

PVPO NUMBER 20050312

PLEASE READ ALL INSTRUCTIONS CAREFULLY:

Place the appropriate number that describes the varietal character of this variety in the boxes below. Place a zero in the first box (e.g., [0][9][9] or [0][9]) when number is either 99 or less or 9 or less respectively. Data for quantitative plant characters should be based on a minimum of 100 plants. Comparative data should be determined from varieties entered in the same trial. Royal Horticultural Society or any recognized color standard may be used to determine plant colors; designate system used: _____. Please answer all questions for your variety; lack of response may delay progress of your application.

1. KIND:

[1]
1 = Common
2 = Durum
3 = Club
4 = Other (Specify) _____

2. VERNALIZATION:

[1]
1 = Spring
2 = Winter
3 = Other (Specify) _____

3. COLEOPTILE ANTHOCYANIN:

[1] 1 = Absent 2 = Present

4. JUVENILE PLANT GROWTH:

[3] 1 = Prostrate 2 = Semi-erect 3 = Erect

5. PLANT COLOR: (boot stage)

[3]
1 = Yellow-Green
2 = Green
3 = Blue-Green

6. FLAG LEAF: (boot stage)

[2] 1 = Erect 2 = Recurved
[2] 1 = Not Twisted 2 = Twisted
[2] 1 = Wax Absent 2 = Wax Present

7. EAR EMERGENCE:

[165] Number of Days (Average)
[03] Number of Days Earlier Than * Winsome (PI 613177)
Same As * Scarlet (PI 601814)
[04] Number of Days Later Than * Macon (PI 617072)

**Relative to a PVPO-Approved Commercial Variety Grown in the Same Trial*

8. ANTHER COLOR:

[1] 1 = Yellow 2 = Purple

9

20050312

9. PLANT HEIGHT: (from soil to top of head, excluding awns)

[091] cm (Average)

[09] cm Taller Than Macon *

Same As No comparison available *

[00] cm Shorter Than No comparison available *

10. STEM:

A. ANTHOCYANIN

[1] 1 = Absent 2 = Present

B. WAXY BLOOM

[1] 1 = Absent 2 = Present

C. HAIRINESS (last internode of rachis)

[1] 1 = Absent 2 = Present

D. INTERNODE

[1] 1 = Hollow 2 = Semi-solid 3 = Solid

[4] Number of Nodes

E. PEDUNCLE

[1] 1 = Erect 2 = Recurved 3 = Semi-erect

[34] cm Length

F. AURICLE

[2] Anthocyanin: 1 = Absent 2 = Present

[1] Hair: 1 = Absent 2 = Present

11. HEAD: (At Maturity)

A. DENSITY

[1] 1 = Lax
2 = Middense (Laxidense)
3 = Dense

B. SHAPE

[1] 1 = Tapering
2 = Strap
3 = Clavate
4 = Other (Specify) _____

C. CURVATURE

[2] 1 = Erect
2 = Inclined
3 = Recurved

D. AWNEDNESS

[4] 1 = Awnless
2 = Apically Awnletted
3 = Awnletted
4 = Awned

12. GLUMES: (At Maturity)

A. COLOR

[1] 1 = White
2 = Tan
3 = Other (Specify) _____

B. SHOULDER

[5] 1 = Wanting 2 = Oblique
3 = Rounded 4 = Square
5 = Elevated 6 = Apiculate
7 = Other (Specify) _____

C. SHOULDER WIDTH

[1] 1 = Narrow
2 = Medium
3 = Wide

D. BEAK

[3] 1 = Obtuse
2 = Acute
3 = Acuminate

E. BEAK WIDTH

[1] 1 = Narrow
2 = Medium
3 = Wide

F. GLUME LENGTH

[3] 1 = Short (ca. 7mm)
2 = Medium (ca. 8mm)
3 = Long (ca. 9mm)

G. WIDTH

[3] 1 = Narrow (ca. 3mm)
2 = Medium (ca. 3.5mm)
3 = Long (ca. 4mm)

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13. SEED:

A. SHAPE

[1] 1 = Ovate
2 = Oval
3 = Elliptical

B. CHEEK

[1] 1 = Rounded
2 = Angular

C. BRUSH

[1] 1 = Short
2 = Medium
3 = Long

1 = Not Collared
2 = Collared

D. CREASE

[1] 1 = Width 60% or less of Kernel
2 = Width 80% or less of Kernel
3 = Width Nearly as Wide as Kernel

[1] 1 = Depth 20% or less of Kernel
2 = Depth 35% or less of Kernel
3 = Depth 50% or less of Kernel

E. COLOR

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[1] 1 = White
2 = Amber
3 = Red
4 = Other (Specify) _____

F. TEXTURE

[1] 1 = Hard
2 = Soft
3 = Other (Specify) _____

G. PHENOL REACTION (See Instructions)

[1] 1 = Ivory
2 = Fawn
3 = Light Brown
4 = Dark Brown
5 = Black

H. SEED WEIGHT

[34] g/1000 Seed (Whole number only)

I. GERM SIZE

[2] 1 = Small
2 = Midsize
3 = Large

14. DISEASE: PLEASE INDICATE THE SPECIFIC RACE OR STRAIN TESTED

(0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

[0]	Stem Rust (*Puccinia graminis* f. sp. *tritici*)	[0]	Leaf Rust (*Puccinia recondita* f. sp. *tritici*)
[4]	Stripe Rust (*Puccinia striiformis*)	[0]	Loose Smut (*Ustilago tritici*)
[0]	Tan Spot (*Pyrenophora tritici-repentis*)	[0]	Flag Smut (*Urocystis agropyri*)
[0]	Halo Spot (*Selenophoma donacis*)	[0]	Common Bunt (*Tilletia tritici* or T. *laevis*)
[0]	*Septoria nodorum* (Glume Blotch)	[0]	Dwarf Bunt (*Tilletia controversa*)
[0]	*Septoria avenae* (Speckled Leaf Disease)	[0]	Karnal Bunt (*Tilletia indica*)
[0]	*Septoria tritici* (Speckled Leaf Blotch)	[0]	Powdery Mildew (*Erysiphe graminis* f. sp. *tritici*)
[0]	Scab (*Fusarium* spp.)	[0]	"Snow Molds"
[0]	"Black Point" (Kernel Smudge)	[0]	Common Root Rot (*Fusarium*, *Cochliobolus* and *Bipolaris* spp.)
[0]	Barley Yellow Dwarf Virus (BYDV)	[1]	Rhizoctonia Root Rot (*Rhizoctonia solani*)
[0]	Soilborne Mosaic Virus (SBMV)	[0]	Black Chaff (*Xanthomonas campestris* pv. *translucens*).
[0]	Wheat Yellow (Spindle Streak) Mosaic Virus	[0]	Bacterial Leaf Blight (*Pseudomonas syringae* pv. *syringae*)
[0]	Wheat Streak Mosaic Virus (WSMV)	[ ]	Other (Specify) _____
[ ]	Other (Specify) _____	[ ]	Other (Specify) _____
[ ]	Other (Specify) _____	[ ]	Other (Specify) _____
[ ]	Other (Specify) _____	[ ]	Other (Specify) _____

15. INSECT: (0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant)

PLEASE SPECIFY BIOTYPE (where needed)

[3]	Hessian Fly (*Mayetiola destructor*)	[ ]	Other (Specify) _____
[0]	Stem Sawfly (*Cephus* spp.)	[ ]	Other (Specify) _____
[1]	Cereal Leaf Beetle (*Oulema melanopa*)	[ ]	Other (Specify) _____

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15. INSECT: (continued) 0 = Not Tested 1 = Susceptible 2 = Resistant 3 = Intermediate 4 = Tolerant

PLEASE SPECIFY BIOTYPE (Where Needed)

2005003 12

0	Russian Aphid (*Diuraphis noxia*)		Other (Specify) _____
0	Greenbug (*Schizaphis graminum*)		Other (Specify) _____
0	Aphids		Other (Specify) _____

16. ADDITIONAL INFORMATION ON ANY ITEM ABOVE, OR GENERAL COMMENTS:

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WHEAT DESCRIPTOR ILLUSTRATIONS

Section Numbers Correspond to the Numbers of the Sections on the Form

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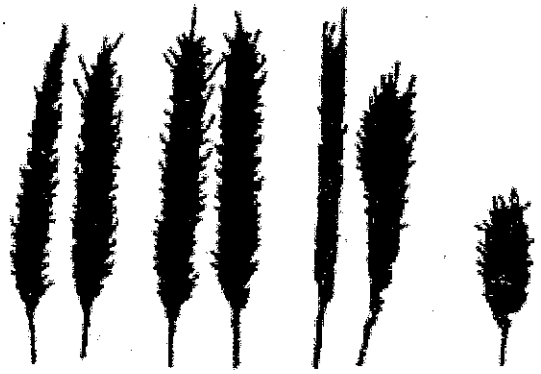
4. EARLY PLANT GROWTH HABIT:

1 Prostrate | 2 Intermediate | 3 Erect

10. STEM INTERNODE X-SECTION:

1 Hollow | 2 Semi-solid | 3 Solid

11. SPIKE SHAPE:

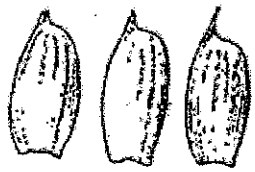


1 Tapering | 2 Oblong | 3 Clavate | 4 Elliptical

11. AWNEDNESS:

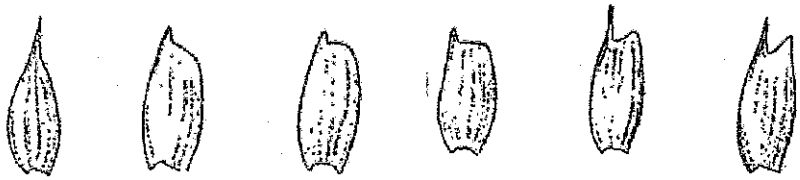
1 Awnless | 2 Apically Awnleted | 3 Awnleted | 4 Awned

12. BEAK SHAPE:



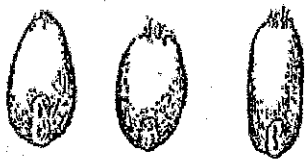
1 Obtuse | 2 Acute | 3 Acuminate

12. SHOULDER SHAPE:



1 Wanting | 2 Oblique | 3 Rounded | 4 Square | 5 Elevated | 6 Apiculate

13. SEED SHAPE:

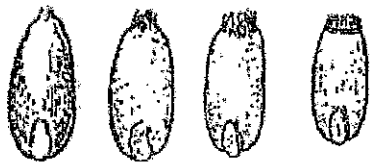


1 Ovate | 2 Oval | 3 Elliptical

13. CHEEK SHAPE:

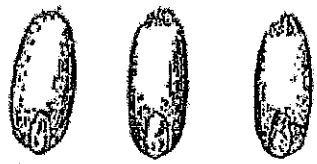
1 Rounded | 2 AngulaR

13. BRUSH SIZE



1 Small | 2 Midsized | 3 Large | 4 Coltared

13. BRUSH HAIR LENGTH:



1 Short | 2 Medium | 3 Long

13. GERM (EMBRYO) SIZE:

1 Small | 2 Midsized | 3 Large

13. SEED CREASE WIDTH:

1 Narrow | 2 Mid-wide | 3 Wide

13. SEED CREASE DEPTH:

1 Shallow | 2 Mid-Deep | 3 Deep

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EXHIBIT D – OPTIONAL SUPPORTING INFORMATION

Milling and Baking Quality:

The end-use quality performance of Otis is compared with hard white spring wheat varieties Idaho 377s and Macon through t-test analyses (Table D1). The grain test weight of Otis is higher (better) than those of Idaho 377s and Macon. The grain protein concentration of Otis is similar to that of Macon, but lower (poorer) than that of Idaho 377s. Thousand kernel weights of the three varieties are similar. The flour yields of Otis are significantly higher (better) than those of Idaho 377s and Macon. The flour ash content of the Otis is similar to Idaho 377s, but higher (poorer) than Macon. The milling score for Otis is higher (better) than that of Idaho 377s and similar to that of Macon. The flour protein concentration of Otis is lower (poorer) than that of Idaho 377s, but similar to that of Macon. Rapid Visco Analyzer (RVA) values of Otis, which reflect starch quality, are lower than those of Idaho 377s, which like Otis, is a partial waxy type, and are significantly higher than Macon, a normal starch type. Mixograph water absorption rates and baking absorption rates for Otis, Idaho 377s and Macon are similar. The dough mixing time for Otis is significantly shorter than those of Idaho 377s and Macon. Otis has significantly larger (better) bread loaf volumes than Idaho 377s, but significantly smaller (poorer) bread loaf volumes than Macon. Alkaline noodle color stability, expressed as the brightness (L*) value of a noodle sheet stored at room temperature for 24 hours, were comparable for Otis and Idaho 377s, but higher (better) for Macon.

In general, Otis has excellent end-use quality properties. Of particular note are its superior milling and bread baking properties compared to Idaho 377s. Based on the 24 hr L* values, this variety also has low polyphenol oxidase activity levels, which is beneficial when making various noodle products.

Table D1: Mean, least significant difference (LSD), probability level (P-value) and number of pair wise comparisons made (N) in t-test analyses for various end-use quality characteristics of the hard white spring wheat cultivars Otis, Idaho 377s and Macon.

Variety	Test Weight (lb/bu)	Grain Protein (%)	Thousand Kernel Weight (g)	Flour Yield (%)	Flour Ash (%)	Milling Score	Flour Protein (%)	Flour RVA (cP/10)	Mixing Absorption (%)	Baking Absorption (%)	Mixing Time (min)	Loaf Volume (cc)	Alkaline Noodle Color Stability (24 hr L*)
Otis	62.6*	13.6	33.3	66.4*	0.41	80.5*	12.3	224	62.2	65.2	3.0	977*	79.6
Idaho 377s	61.7	14.3*	32.5	62.1	0.40	76.5	12.8*	243*	62.6	66.4	4.2*	930	79.8
LSD	0.5	0.3	1.2	0.5	0.01	0.8	0.3	10	0.6	0.8	0.3	25	0.9
P-value	<0.01	<0.01	0.16	<0.01	0.09	<0.01	<0.01	<0.01	0.17	0.27	<0.01	<0.01	0.60
N	28	28	27	28	28	28	28	24	26	26	26	26	26
Otis	62.5*	13.7	32.5	66.0*	0.41	80.0	12.5	227*	62.4	66.2	3.1	989	79.7
Macon	60.9	13.8	32.2	64.9	0.39*	79.8	12.3	203	62.0	65.7	4.7*	1051*	80.6*
LSD	0.7	0.5	1.4	1.0	0.01	1.1	0.5	11	0.4	0.6	0.4	27	0.6
P-value	<0.01	0.82	0.65	0.02	0.01	0.71	0.50	<0.01	0.09	0.10	<0.01	<0.01	<0.01
N	20	20	20	19	20	19	20	20	19	20	20	20	20

*Significantly different ($P \leq 0.05$)

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

Application is required in order to determine if a plant variety protection certificate is to be issued *(7 U.S.C. 2421)*. The information is held confidential until the certificate is issued *(7 U.S.C. 2426)*.

1. NAME OF APPLICANT(S)	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER	3. VARIETY NAME
Washington State University Research Foundation	WA007931	Otis
4. ADDRESS *(Street and No., or R.F.D. No., City, State, and ZIP, and Country)*	**5. TELEPHONE** *(Include area code)*	**6. FAX** *(Include area code)*
1610 NE Eastgate Blvd. Pullman, WA 99163	(509) 335-4363	(509) 335-7237
	7. PVPO NUMBER 200500312	

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. **If no, please explain.** ☑ YES ☐ NO

9. Is the applicant (individual or company) a U.S. national or a U.S. based company? **If no, give name of country.** ☑ YES ☐ NO

10. Is the applicant the original owner? ☐ YES ☑ NO **If no, please answer one of the following:**

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?
☑ YES ☐ NO **If no, give name of country**

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?
☐ YES ☐ NO **If no, give name of country**

11. Additional explanation on ownership *(Trace ownership from original breeder to current owner. Use the reverse for extra space if needed)*:

'Otis' was developed by Dr. Kimberlee K. Kidwell, Spring Wheat breeder and geneticist at Washington State University.

Washington State University's ownership interests were assigned to the Washington State University Research Foundation.

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.